

In this Amendment, Applicants have editorially amended the specification and various ones of the claims. Further, claim 5 has been amended to depend from independent claim 1, and claim 7 has been amended into independent form. Claims 12 and 13 have been added to the application. Claims 1 and 7 are the independent claims. Claims 1-13 are pending in the application. For at least the following reasons, it is submitted that this application is in condition for allowance.

The Examiner has objected to the disclosure for various informalities. In response thereto, the informalities specifically noted by the Examiner have been corrected. Moreover, other informalities noted during the review have likewise been corrected. It is submitted that the disclosure complies with all official provisions, and it is requested that this objection be withdrawn.

The Examiner has rejected the claims as being anticipated by *Hancock* (USP 5,377,555). It is submitted that these claims are patentably distinguishable over the cited reference for at least the following reasons.

Applicants' independent claim 1 recites a tilt steering apparatus that includes, *inter alia*, a cam surface and a cam follower which are relatively rotated while being brought into sliding contact with each other as a lock lever is rotated. The cam surface includes a locking position in which the steering column is locked in an adjusted tilt position, and a releasing position in which the steering column is unlocked so as to be free to be adjusted to a desired tilt position. The cam surface further includes an intermediate position disposed between the locking position and the releasing position. The intermediate position includes a plurality of slopes corresponding to a rotation stroke position of the lock lever.

Applicants' claimed invention results in a tilt steering apparatus in which the operation force when moving a lock lever to a locking position can be reduced without requiring an increase in the operating angle of the lock lever, due to the plurality of slopes being provided in the intermediate position. This configuration is particularly advantageous when using a cam and a cam follower which are in sliding contact, due to the increased frictional resistance that occurs therebetween. This claimed configuration is not disclosed (nor suggested) by the cited reference.

Hancock discloses a steering column clamping mechanism in which a roller 11 is brought into rolling engagement with a surface of a cam 10. This reference discloses that the cam 10 includes an unclamped position 10B, which is referred to in claim 1 of this patent as a first zone. This reference further discloses a clamped position which extends from point 10D to point 10C. Point 10D is referred to in the claim 1 as a third zone and point 10C is referred to in the claim 1 as a second zone. As is illustrated, the position 10C is lower than the position 10D, to retain the roller 11 in the clamped position after it passes the point 10D. This configuration is necessary due to the use of the roller, which would otherwise roll down the slope 10A.

However, and in contrast to the present invention, this reference does not disclose or otherwise suggest a cam surface and a cam follower which are brought into sliding contact with each other as the lock lever is rotated. Instead, and as noted above, the cam surface and the roller 11 are brought into rolling engagement with each other, rather than sliding contact as required by Applicants' independent claims.

Moreover, Applicants' claimed invention recites that there are a plurality of slopes in an intermediate position that is disposed between a locking position and a releasing

position of the cam surface. In contrast, the reference discloses providing only one slope 10A between when the mechanism is clamped at point 10D, and the point where the mechanism is unclamped at position 10B. As such, it is submitted that Applicants' independent claim 1, and the claims dependent therefrom, are *prime facie* patentably distinguishable over the cited reference. It is requested that these claims be allowed.

Furthermore, Applicants' independent claim 7 recites that the cam surface and the cam follower are brought into sliding contact with each other while the lock lever is rotated. This claim further recites that the cam follower includes a cam follower surface having an edge, with the cam follower surface being substantially brought into sliding contact with the cam surface at the edge in correspondence with at least a front of a stroke in the locking releasing direction of the lock lever. As noted above, the cited reference does not disclose or otherwise suggest such sliding contact. Moreover, this reference discloses providing a roller 11 as a cam follower. The roller 11 has a circular shape, and thus does not have an edge, so this reference could not possibly disclose or otherwise suggest an edge of a cam follower which is substantially brought into sliding contact with a cam surface at the edge, as recited in Applicants' independent claim 7. As such, it is submitted that Applicants' independent claim 7, and the claims dependent therefrom, are *prime facie* patentably distinguishable over the cited reference. It is requested that these claims be allowed and it is further requested that these rejections be withdrawn.

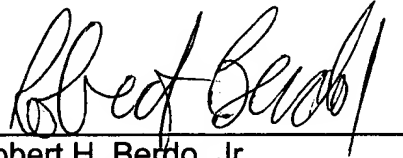
Applicants have also added dependent claims 12 and 13, which define the first and second slopes as sloping upward in the same direction, with the second slope being gentler than the first slope, and with the first and second slopes each being linear.

These particular features are neither disclosed nor suggested by the cited reference. It is likewise requested that these claims be allowed.

It is submitted that this application is in condition for allowance. Such action and the passing of this case to issue are requested.

Should the Examiner feel that a conference would help to expedite the prosecution of the application, the Examiner is hereby invited to contact the undersigned counsel to arrange for such an interview.

Respectfully submitted,



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Date

RHB:crh



VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

Please amend the specification as follows:

Page 1, line 3, through line 8, please replace the current paragraph with the following replacement paragraph:

--The application claims priority benefits under 35 USC § 119 of Japanese Patent Application Serial No. 2000-244877 filed on August 11, 2000 and Japanese Patent Application Serial No. 2000-276854 filed on September 12, 2000, the [disclosure] disclosures of which [is] are incorporated by reference.--

Page 1, line 14, through line 22, please replace the current paragraph with the following replacement paragraph:

--There is a tilt steering apparatus so adapted that the height of a steering wheel can be changed depending on the physical constitution of a driver, the driving position, or the like. An example [of the tilt steering apparatus] is a telescopically adjustable tilt steering apparatus in which the position of a steering wheel is adjusted along the axis of a steering shaft.--

Page 2, line 14, through line 18, please replace the current paragraph with the following replacement paragraph:

--The present invention has been made in view of the above-mentioned problems, and has as its object to provide a tilt steering apparatus capable of obtaining a suitable operating torque of a lock lever and having good operability.--

Page 6, line 16, through Page 7, line 2, please replace the current paragraph with the following replacement paragraph:

--Fig. 1 is a longitudinal sectional view of a steering column in a tilt telescopic steering apparatus according to an embodiment of the present invention, and Fig. 2 is a partially broken side view of a lock lever and a portion to which the lock lever is attached. Referring to Fig. 1, a tilt telescopic steering apparatus [1] (hereinafter merely referred to as a steering apparatus [1]) comprises a steering column 2 for supporting a steering shaft 1 having a steering wheel fixed to its upper end in the axial direction so as to be rotatable.--

Page 7, line 12, through line 25, please replace the current paragraph with the following replacement paragraph:

--A fixed bracket 8 is fixed to a vehicle, and is in the shape of a groove opening downward. Bracket 8 comprises [comprising] a pair of side plates 9 and 10 opposite to each other and an upper plate 11 connecting intermediate portions at upper ends of the side plates 9 and 10 to each other. A vertically long hole 12 in the shape of a circular arc is formed in each of the side plates 9 and 10. Reference numerals 13 and 14 denote mounting stays formed by folding upper edges of parts of the side plates 9 and 10 outward. The fixed bracket 8 is fixed to the vehicle by a bolt passing through a

screw insertion hole formed in each of the mounting stays 13 and 14, which is not illustrated.--

Page 8, line 20, through Page 10, line 25, please replace the current paragraphs with the following replacement paragraphs:

--Referring to Fig. 2, the lock lever 16 has a longitudinal main unit 41. A connecting section 23 connected to a cam 22, described later, so as to be integrally rotatable is provided at one end of the main unit 41, and a grip 42 to be gripped by a driver is provided at the other end of the main unit 41. Reference numeral 43 is a stopper plate which is screwed to the vicinity of one end of the main unit 41 to abut against a nut 24. The stopper plate 43 [penetrates] prevents the nut 24 from turning. In Fig. 2, reference numeral 21 denotes a cam follower engaged with the cam 22, and reference numeral 25 denotes a shim.

Referring to Fig. 1 again, the supporting shaft 15 is guided [to] in the vertically long hole 12 so that only vertical sliding is allowed with respect to the fixed bracket 8. On the other hand, the vertically long hole 7 [allows] prevents the steering column 2 including the tilt bracket 4 from moving back and forth with respect to the supporting shaft 15.

The supporting shaft 15 is composed of a bolt having a head 17, a body 18 composed of a circular cylinder, and a screw portion 19. The body 18 penetrates the side plates 5 and 6 of the bracket 4 and the side plates 9 and 10 of the bracket 8[, and the head 17 has a] . A plain washer 20 is interposed between the head 17 and an outer surface of the side plate 10 of the fixed bracket 8.

On the other hand, the screw portion 19 of the supporting shaft 15 and a part of the body 18 connecting therewith project outward from the side plate 9 of the fixed bracket 8, and an annular cam follower 21 is fitted [in] on a part of the body 18. The cam follower 21 is brought into contact with an outer surface of the side plate 9 of the fixed bracket 8. Further, the cam follower 21 has a projection inserted through the vertically long hole 12 of the side plate 9. Consequently, the rotation of the supporting shaft 15 around a center axis C is bound by the side plate 9 of the fixed bracket 8.

An annular cam 22 which is brought into contact with the cam follower 21 is fitted [in] on the screw portion 19 so as to be relatively rotatable. The connecting section 23 of the lock lever 16 is connected to the cam 22 so that the lock lever 16 and the cam 22 are integrally rotated. A nut 24 with a flange is screwed into the screw portion 19. The nut 24 positions the cam 22 along the axis of the supporting shaft 15 through the annular shim 25 and the connecting section 23 of the lock lever 16. The inner periphery of the annular connecting section 23 may be in a polygonal shape such as a hexagonal shape or a shape having a width across flat on its circumference.--

Page 11, line 12, through line 20, please replace the current paragraph with the following replacement paragraph:

--As shown in Fig. 3A, a pair of a first positioning section 26 for positioning the cam follower 21 at the time of releasing locking, and a second positioning section 27 for positioning the cam follower 21 at the time of locking are provided so as to be opposite to each other with a center axis of the cam 22 (i.e., the center axis C of the supporting shaft 15) on a surface 22a, opposite to the cam follower 21, of the cam 22.--

Page 15, line 11, through Page 16, line 10, please replace the current paragraphs with the following replacement paragraphs:

--The third slope 39 is positioned at the rear of the fastening stroke of the lock lever. An angle of inclination A to a plane perpendicular to a center axis C1 of the cam 22 is set to approximately 1° , for example (which may be in the range of 0.5° to 1.5°), and a top (crest) 40 is formed between the second slope 38 and the third slope 39.

On the other hand, referring to Figs. 7A and 7B, a plurality of projections 46 forming a trapezoidal shape [being trapezoidal] in cross section which are brought into sliding contact with the cam surface 31 of the cam 22 are equally spaced in the circumferential direction on a surface 45, opposite to the cam 22, of the cam follower 21. A cam follower surface 47 composed of a top surface of the projection 46 is inclined at an angle of inclination ($B = A$, which is 1° , for example) equal to that of the third slope 39 to a plane perpendicular to a center axis C2 of the cam follower 21. As shown in Fig. 7A, the cam follower surface 47 and the third slope 39 are inclined at an equal angle of inclination in opposite directions and are brought into surface contact with each other.--

Page 16, line 17, through Page 17, line 11, please replace the current paragraph with the following replacement paragraph:

--Particularly referring to Figs. 8A and 8B, the third slope 39, serving as a slope adjusting section, which is [an] slightly inclined inverse slope [but is hardly inclined] is provided on the cam surface 31 in correspondence with the rear of the stroke in the fastening direction of the lock lever 16 whose operating torque is liable to be increased.

Consequently, the lever ratio of the lock lever at the rear of the fastening stroke (corresponding to the ratio of the amount of displacement of the cam follower 21 to the increment of the operating angle of the lock lever) can be increased. As a result, the operating torque can be reduced, thereby making it possible to significantly improve the operability of the lock lever 16. In Fig. 8B, an arrow Y indicates the direction of movement of the cam 22 relative to the cam follower 21 in a case where the lock lever 16 is operated in the locking direction.--

Page 20, line 5, through line 20, please replace the current paragraph with the following replacement paragraph:

--In an embodiment shown in Fig. [12] 13, a recess 52 concaved by providing a step 51 may be provided at the rear of a fastening stroke of the portion having no slope 50[, as shown] . As shown in Fig. 13, the angle of inclination B of the cam follower surface 47 may be also reduced to zero ($B = 0$) to have no slope, and a projection 53 fitted in the recess 52 may be provided at the rear of the fastening stroke of the cam follower surface 47. Also in this case, when the lock lever 16 is operated in the releasing direction, the projection 53 moves beyond the step 51, so that contact surface pressure between the cam surface 31 and the cam follower surface 47 is increased once, thereby making it possible to increase the operating torque at the time of a lock releasing operation.--

IN THE CLAIMS:

Please amend the claims as follows:

1. (Amended) A tilt steering apparatus [comprising] for a tilt adjustable steering column, comprising:

a fixed bracket fixed to a body of a vehicle, and having side plates;

a tilt bracket fixed to the steering column[;] and having side plates [provided in the fixed bracket; side plates provided in the tilt bracket and sliding] positioned to slide along the side plates of the fixed bracket at a time of tilt adjustment;

a supporting shaft passing through respective insertion holes of the side plates of the fixed bracket and of the side plates of the tilt bracket;

a lock lever rotatable around an axis of said supporting shaft and in [the] a locking direction to lock the steering column in an adjusted tilt position, and [the] being rotatable around the axis of said supporting shaft and in a locking releasing direction [around an axis of the supporting shaft and rotated in the locking direction to lock the steering column to an adjusted tilt position]; and

a cam surface and a cam follower which are relatively rotated while being brought into sliding contact with each other as the lock lever is rotated,

the cam surface including a locking position in which the steering column is locked in the adjusted tilt position, a releasing position in which the steering column is unlocked so as to be free to be adjusted to a desired tilt position, and an intermediate position disposed between the locking position and the releasing position, the intermediate position including a plurality of slopes corresponding to a rotation stroke position of the lock lever,

the cam surface pressing the cam follower as the lock lever is rotated in the locking direction so that the side plates of [both] the fixed bracket[s] and the side plates of the tilt bracket are pressed against each other, resulting in the steering column being locked at the adjusted tilt position.

2. (Amended) The tilt [steering] steering apparatus according to claim 1, wherein

the cam follower is moved in a first direction relative to the cam surface when the lock lever is [stroked] rotated in the locking direction,

the plurality of slopes of the cam surface includes first and second slopes which [are] slope upward [slopes] in the first direction, the second slope being gentler than the first slope, and

the cam follower slides from the first slope of the cam surface to the second slope thereof when the lock lever is [stroked] rotated in the locking direction.

3. (Amended) The tilt steering apparatus according to claim 2, wherein

the plurality of slopes of the cam surface includes a third slope which [is an] slopes upward [slope] in the first direction, the third slope being gentler than the second slope, and

the third slope corresponds to a rear of a stroke in the locking direction of the lock lever, and

the cam follower successively slides toward the first, second and third slopes of the cam surface in this order when the lock lever is [stroked] rotated in the locking direction.

4. (Amended) The tilt steering apparatus according to claim 2, wherein the plurality of slopes of the cam surface includes an inverse slope which [is a] slopes downward [slope] in the first direction, the inverse slope corresponds to a rear of a stroke in the locking direction of the lock lever, and the cam follower slides toward the first and second slopes and the inverse slope of the cam surface in this order when the lock lever is [stroked] rotated in the locking direction.

5. (Amended) [A] The tilt steering apparatus according to claim 1, [comprising a tilt adjustable steering column,] further comprising:

[a fixed bracket fixed to a body of a vehicle;
a tilt bracket fixed to the steering column;
side plates provided in the fixed bracket;
side plates provided in the tilt bracket and sliding along the side plates of the fixed bracket at a time of tilt adjustment;
a supporting shaft passing through respective insertion holes of the side plates of the fixed bracket and the tilt bracket;

a lock lever rotatable in the locking direction and the locking releasing direction around an axis of the supporting shaft and rotated in the locking direction to lock the steering column to an adjusted tilt position;

a cam surface and a cam follower which are relatively rotated while being brought into sliding contact with each other as the lock lever is rotated; and]

means for increasing an operating torque of the lock lever at a front of a stroke in the locking releasing direction of the lock lever, and

wherein the cam surface and the cam follower [constituting] constitute means for increasing the operating torque of the lock lever[,

the cam surface pressing the cam follower as the lock lever is rotated in the locking direction of the lock lever so that the side plates of both the brackets are pressed against each other, resulting in the steering column being locked in the adjusted tilt position].

6. (Amended) The tilt [steeling] steering apparatus according to claim 5, wherein

the cam follower is moved in a first direction relative to the cam surface when the lock lever is [stroked] rotated in the locking direction,

the cam surface includes an inverse slope which [is a] slopes downward [slope] in the first direction, and

the inverse slope of the cam surface corresponds to [the] a front of [the] a stroke in the locking releasing direction of the lock lever.

7. (Amended) [The] A tilt steering apparatus [according to claim 5] for a tilt adjustable steering column, comprising:

a fixed bracket fixed to a body of a vehicle, and having side plates;

a tilt bracket fixed to the steering column and having side plates positioned to slide along the side plates of the fixed bracket at a time of tilt adjustment;

a supporting shaft passing through respective insertion holes of the side plates of the fixed bracket and of the side plates of the tilt bracket;

a lock lever rotatable around an axis of said supporting shaft and in a locking direction to lock the steering column in an adjusted tilt position, and being rotatable around the axis of said supporting shaft and in a locking releasing direction;

a cam surface and a cam follower which are relatively rotated while being brought into sliding contact with each other as the lock lever is rotated; and

means for increasing an operating torque of the lock lever at a front of a stroke in the locking releasing direction of the lock lever,

the cam surface and the cam follower constituting means for increasing the operating torque of the lock lever,

the cam surface pressing the cam follower as the lock lever is rotated in the locking direction of the lock lever so that the side plates of the fixed bracket and the side plates of the tilt bracket are pressed against each other, resulting in the steering column being locked in the adjusted tilt position, and wherein

the cam follower includes a cam follower surface having an edge, the cam follower surface being [which is] substantially brought into sliding contact with the cam

surface at [an] the edge in correspondence with at least [the] a front of [the] a stroke in the locking releasing direction of the lock lever.

9. (Amended) The tilt steering apparatus according to claim 5, wherein the cam surface includes an area corresponding to [the] a front of [the] a stroke in the locking releasing direction of the lock lever, and a recess concaved by providing a step in the area.